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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole 10-02-01

Borehole Information

Farm : A	**Tank :** A-102	**Site Number :** 299-E25-90
N-Coord : 41,240	**W-Coord :** 47,670	**TOC Elevation :** 687.87
Water Level, ft :	**Date Drilled :** 4/30/1962	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 130	

Cement Bottom, ft. : 130 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 10-02-01 was originally drilled in April 1962 and completed to a depth of 75 ft with 6-in.-diameter casing. In 1978, the borehole was deepened to a completed depth of 125 ft. An 8-in. casing was temporarily installed to a depth of 18 ft. Forty-five gal of grout was added to the annulus between the 6-in. and 8-in. casings; the 8-in. casing was then removed. An additional 9 gal of grout was added to the bottom of the borehole. There is no mention in the driller's log that the casing was perforated.

"As-built" drawings for the A Tank Farm indicate the original borehole was constructed with 6-in., schedule-30 pipe; however, this type of pipe was not identified in applicable engineering references. The casing thickness for the borehole is assumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. casing.

The top of the casing is the zero reference for the log. The casing lip is approximately even with the ground surface.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1996	**Calibration Reference :** GJO-HAN-13	**Logging Procedure :** P-GJPO-1783

Logging Information

Log Run Number : 1	**Log Run Date :** 11/18/1996	**Logging Engineer:** Bob Spatz
Start Depth, ft.: 0.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 47.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Log Event A

Log Run Number :	2	**Log Run Date :**	11/20/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	124.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	46.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	11/18/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	23.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	16.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	11/21/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	17.5	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	6.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged in four log runs. Two of the log runs constitute a relog of the borehole for quality assurance purposes. The total logging depth achieved by the SGLS was 124 ft.

Analysis Information

Analyst : S.D. Barry

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 03/02/1998

Analysis Notes :

The pre- and post-survey field verification spectra for all logging runs met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from these spectra were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing (based on a 6-in., schedule-40 pipe) were applied to the entire logged interval during the analysis process.

Shape factor analysis was applied to the SGLS data and provided insights into the distribution of Cs-137 contamination and into the nature of zones of elevated total count gamma-ray activity not attributable to gamma-emitting radionuclides.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

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A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

A rerun plot for the interval between 6 and 23 ft is included.

A plot of the shape factor analysis results is included. The plot is used as an interpretive tool to help determine the radial distribution of man-made contaminants around the borehole.

A time-sequence plot of the historical gross gamma log data from 1975 to 1992 is presented with the log plots.

Results/Interpretations:

The only man-made radionuclide detected in this borehole was Cs-137. Cs-137 contamination was detected nearly continuously from the ground surface to 19 ft and from 76.5 to 83.5 ft. Cs-137 contamination was also detected at levels just above the MDL at 50, 50.5, 85, and 87 ft and from 114 to 116.5 ft.

The K-40 log plot shows an interval of decreased concentrations between 5 and 14 ft. At a depth of about 48 ft, the U-238 concentrations decrease slightly. At 107 ft, the K-40 concentration values increase from about 13 to 15 pCi/g. The Th-232 concentrations also increase at a depth of about 105 ft.

The interval from 6 to 24 ft was relogged as a quality assurance measure. The comparison between the original log run and the rerun log was generally within the two-sigma uncertainty, indicating the excellent repeatability of the logging measurement.

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factor analysis for the interval from the ground surface to about 18 ft is not valid because of the presence of grout on the outside of the borehole casing. The Cs-137 contamination was measured above the 1 cps threshold from about 77 to 83 ft. CsSF1 indicates the Cs-137 contamination is uniformly distributed in the sediments surrounding the borehole.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank A-102.